Interactive Shooting Game: Galaxian

(Image courtesy of wikipedia.org)

Danny Vo and Jeff Yuan
Galaxian: History

• Based on the formula developed by Space Invaders
• Released by Namco in 1979
• First arcade game to feature true color
• Spawned a host of sequels, Galaga (1981), Gaplus (1984), Galaga ’88 (1987), etc.
Game Rules

• Player controls ship located at bottom of screen
• Groups of aliens (up to 15-25) are located at the top of the screen
• The player attempts to destroy the aliens by firing projectiles that travel vertically upward
• Occasionally, aliens move away from their formation and makes a kamikaze attack at the player’s ship
• Each level is over when the player destroys all aliens on the screen or when the player’s ship is destroyed
Controller Schemes

• Player ship is controlled by left to right movement of an LED board in front of a video camera.

• If the LED controller moves upward with a certain velocity, a firing action is registered.

• Optionally, keyboard can also be used as controller
Display

- XVGA Resolution: 1024 by 768. Clock at 65Mhz.
- Will only use half of the screen for game, since it is vertical in nature. So game resolution is 512 by 768.
High Level Overview

Video Camera → Video Processor → VGA Controller → LCD Monitor

Input Handler → Game Logic
Game Logic

Map Background

Start Game

Alien

Alien next x_y confirm

Collision Detection

Ship

Ship next x_y confirm

Game FSM

Bullet

Bullet next x_y confirm

update score

update lives
Collision Detector

ship next_x_y
alien next_x_y
bullet next_x_y
ship enable
alien enable
bullet enable
alien in ship zone
bullet in alien zone
alien ai mode
ship next_x_y ready
alien next_x_y ready
bullet next_x_y ready

Legend
N - number of alien (10 for now)
VGA Output

- VGA Output
- Mux Gate
- BRAM
- Frame Swapper
- To VGA output
- Frame Swapper inputs:
  - Map RGB (8 bits)
  - Ship RGB (8 bits)
  - Alien RGB (8 bits)
  - Bullet RGB (8 bits)
- BRAM inputs:
  - Read data (16 bits)
  - Write data (16 bits)
- BRAM outputs:
  - Read data (16 bits)
  - Write data (16 bits)
- Output to VGA (24 bits)
Video Processing

Clock 27Mhz

Camera → AD7185

ntsc decode → color converter

ntsc to zbt → zbt ram

vram display

Clock 65Mhz

tv_ycrcb

tyrcb

ing input

ship_velocity

ship_control_logic

rgb

rgb_ntsc_data

vram_addr

vram_read_data

vram_pixel

x,y

30

24

36

11

3

21

19

36
Project Timeline

• 11/17:
  – Video processing
  – Ship, bullet, alien module, should be able to run simple test version

• 11/21:
  – Game FSM, Collision detector:
  – Sprite and ROM

• 11/29:
  – VGA output
  – Full game working
  – Integration
Questions?